REPORT 28

SWEEP

SOIL AND WATER

ENVIRONMENTAL

ENHANCEMENT PROGRAM

PAMPA

PROGRAMME D'AMÉLIORATION

DU MILIEU PÉDOLOGIQUE

ET AQUATIQUE

Canadä

Ontario

SWEEP

is a $30 million federal-provincial agreement, announced May 8, 1986, designed to improve soil and water quality in southwestern Ontario over the next five years.

PURPOSES

There are two interrelated purposes to the program; first, to reduce phosphorus loadings in the Lake Erie basin from cropland run-off; and second, to improve the productivity of southwestern Ontario agriculture by reducing or arresting soil erosion that contributes to water pollution.

BACKGROUND

The Canada-U.S. Great Lakes Water Quality Agreement called for phosphorus reductions in the Lake Erie basin of 2000 tonnes per year. SWEEP is part of the Canadian agreement, calling for reductions of 300 tonnes per year — 200 from croplands and 100 from industrial and municipal sources.

PAMPA

est une entente fédérale-provinciale de 30 millions de dollars, annoncée le 8 mai 1986, et destinée à améliorer la qualité du sol et de l'eau dans le Sud-ouest de l'Ontario.

SES BUTS

Les deux buts de PAMPA sont: en premier lieu de réduire de 200 tonnes par an d'ici 1990 le déversement dans le lac Erie de phosphore provenant des terres agricoles, et de maintenir ou d'accroître la productivité agricole du Sud-ouest de l'Ontario, en réduisant ou en empêchant l'érosion et la dégradation du sol.

SES GRANDES LIGNES

L'entente entre le Canada et les États-unis sur la qualité de l'eau des Grands Lacs prévoyait de réduire de 2 000 tonnes par an la pollution due au phosphore dans le bassin du lac Erie. PAMPA fait partie de cette entente qui réduira cette pollution de 300 tonnes par an — 200 tonnes provenant des terres agricoles et 100 tonnes provenant de sources industrielles et municipales.

TECHNOLOGY EVALUATION AND DEVELOPMENT SUB-PROGRAM

THE EFFECT OF SPLIT APPLICATIONS OF NITROGEN ON CORN YIELD UNDER RIDGE AND NO-TILL CONDITIONS

FINAL REPORT

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Disclaimer:	The views contained herein do not necessarily reflect the views of the Government of Canada or the SWEEP Management Committee.

EXECUTIVE SUMMARY

Trials were carried out on two farms in Huron County to examine the relative merits of splitting the timing of the application of nitrogen fertilizer between planting and sidedress applications. Current findings have been that in southwestern Ontario sidedress applications of nitrogen have a yield advantage over preplant applications. Thus more nitrogen must be applied if the total season application is applied on or before the date of planting, relative to where a large portion of the nitrogen is applied later in the season, closer to the time of consumption by corn.

The experiments involved applications of 0, 20 and 40% of the seasonal application of nitrogen at the time of planting, with the remainder of the nitrogen sidedressed. Trials were carried out in each of a no-till and ridge-till system.

There was no evidence from these trials to support the practice of splitting nitrogen applications or for the application of the entire season's nitrogen at sidedressing. However, in light of this study having been limited to one year's data collection, further testing may be warranted to more thoroughly examine the relationship of nitrogen timing and crop nutrition and grain yields.

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1. INTRODUCTION

The Technology and Development (TED) subprogram of SWEEP was established to facilitate the evaluation of existing technologies and the adaptation of these or new technologies for soil conservation purposes.

An important objective of TED is the involvement of the farming community in the process of developing and refining technologies and systems. In Huron county there has been interest expressed by farmers in more efficient use of nitrogen on corn, and also, on soybeans in small amounts early in the season when it may compensate for a lag in nodule development.

The concept of splitting the nitrogen application for corn represents a fine tuning of the production system. It has been well established in other research in Ontario that more nitrogen must be applied if the total season rate is applied on or before the date of planting, than in situations where a large portion of the nitrogen is applied as a sidedressing later in the season, closer to the time of consumption.

Publication 296 (OMAF, 1988) states that in southwestern Ontario sidedress applications have shown a slight yield advantage over preplant applications. Farmers have concern that nitrogen applications are needed early in the season to get corn off to a good start, and that nitrogen may help in overcoming any phytotoxic effects of crop residues in conservation tillage.

In the interest of alleviating the risk of phosphorus contamination of the environment or because less phosphorus is needed as the result of existing high levels of soil-P, a producer may reduce the quantity of starter fertilizer he applies. In this situation less nitrogen can be added as starter. Additional nitrogen might then need to be applied separately in the fertilizer band at planting time. The producer recognizes that a split application might be conveniently and cheaply applied by incorporating a portion of the nitrogen requirement at that time. The farmer needs to know the optimum amount of nitrogen to be used early in the season.

2. OBJECTIVE

The experiments involving split nitrogen applications to corn test the effect of three

proportions of nitrogen applied at planting time. The study intends to determine the probable optimum quantity of nitrogen to be applied in advance of the sidedress application.

3. METHODS

3.1 Site Description

Trials were located on two farms in Huron County. One farm was in Hullett Twp. on a Listowel silt loam. The farm had been in no tillage crop production for 5 years. The previous crop was corn. A second farm was in Goderich Twp. on a field with Perth clay loam and Listowel loam soils. The farm had been in ridge-till crop production for 3 years. The previous crop was soybeans.

3.2 Treatment Application

A portion of the nitrogen fertilizer input was applied in the fertilizer band at planting. The overall rate of nitrogen was that recommended by OMAF, 160 kg N/ha, of which three rates, 0, 30, and 60 kg N/ha were applied on the starter fertilizer band. The band was 28% N which was dispensed through an adjusted squeeze pump and multiple tubes to accommodate rates and planting rows. At sidedressing the remaining quota of nitrogen fertilizer was applied conventionally.

Corn (Pioneer 3790) was seeded at 68,400 seeds per hectare (27,700 seeds acre^{-1}) on May 12, 1988 at the no-till site and on May 6, 1988 at the ridge till site. The sidedress application was carried out on July 8, 1988 for the no-till and at the time of ridge cultivation (June 4, 1988) on the ridge till site.

3.3 Biotic Measurements

Leaf samples consisting of the ear node leaf from 10 plants within each plot were taken from plants with most recently emerged silks when 50% of the population had silked. Samples were dried at 80° C. Ear leaf samples were analyzed for nitrogen content which was used as an indicator of the corn plant's nutrition (Keeney and Nelson, 1982).

Yield measurements were taken on the full planter width using the farmer's combine on

both sites.

3.4 Experimental Design and Statistical Analysis

The experiment was set up as a randomized complete block with four replications. Analysis of variance was carried out and significant effects were examined (Steel and Torrie, 1980). Significance was at $p \leq 0.05$.

4. RESULTS AND DISCUSSION

4.1 Ear Leaf Nitrogen

The overall analysis of variance revealed a marginally significant ($p=0.054$) interaction of the tillage methods and the nitrogen application methods (Appendix A).

Examination of the effects of nitrogen applications at each site showed that in no-till the 30/130 split nitrogen application resulted in significantly lower ear leaf nitrogen (2.28% N) than the other two methods of application (avg. 2.4% N). In the ridge till, however, the 30/130 split nitrogen resulted in the highest levels of ear leaf nitrogen. This was significantly greater than the complete sidedress application.

All ear-leaf nitrogen levels in both the zero and ridge tillage were slightly below the 2.5% critical concentration (OMAF, 1988). This means that all corn, regardless of nitrogen application timing and tillage method used, might be expected to experience yield losses due to nitrogen deficiency. It is assumed that the deficiency relates to the conditions of 1988 in which this part of Ontario received less than normal rainfall.

Table 1: Effects of Tillage and Nitrogen Applications on Corn Ear Leaf Nitrogen.

Tillage	Nitrogen Level	Ear Leaf Nitrogen (%)
No-Till	0/160	2.40
	30/130	2.20
	60/100	2.38
Ridge-Till	0/160	2.27
	30/130	2.37
	60/100	2.31

4.2 Grain Yield

Overall analysis of variance revealed no effect of the nitrogen treatments and no interaction of the timing of the nitrogen application and the tillage method (Appendix B). Corn grain yields were marginally lower ($p=0.096$) on the no-till (6.88 t/ha) than on the ridge-till (7.11 t/ha) site.

Overall grain yields were 7.0 t/ha and no yield advantages or disadvantages emerged from splitting the application of nitrogen.

Table 2: Effects of Tillage and Nitrogen Applications on Corn Grain Yields.

Tillage	Nitrogen Level	Grain Yield t/ha (bu/ac)
No-Till	0/160	6.60 (105.3)
	30/130	7.00 (111.6)
	60/100	7.04 (112.3)
Mean		6.88 (109.7)
Ridge-Till	0/160	7.07 (112.7)
	30/130	7.16 (114.1)
	60/100	7.09 (113.1)
Mean		7.11 (113.3)

5. GENERAL DISCUSSION

On the basis of the limited data provided by the trials carried out on two sites and for one growing season and calendar year, no evidence can be produced to support the practice of splitting nitrogen applications or for applying nitrogen entirely sidedressed. Further testing in this direction is warranted to evaluate the merits of applying a portion of the season's nitrogen at planting.

6. REFERENCES

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Ontario Ministry of Agriculture and Food. 1988. 1989-1990 Field Crop Recommendations. Publication 296. Queen's Printer for Ontario, 1988.

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APPENDIX A: Analysis of Variance, Percent Ear Leaf Nitrogen

Source	df	MS	F	P
Tillage	1	0.009	1.277	0.273
Nitrogen	2	0.001	0.158	0.855
Tillage x Nitrogen	2	0.025	3.438	0.054
Error	18	0.007		

APPENDIX B: Analysis of Variance, Corn Grain Yield

Source	df	MS	F	P
Tillage	1	76.062	3.076	0.096
Nitrogen	2	38.389	1.553	0.239
Tillage x Nitrogen	2	23.661	0.957	0.403
Error	18	24.727		